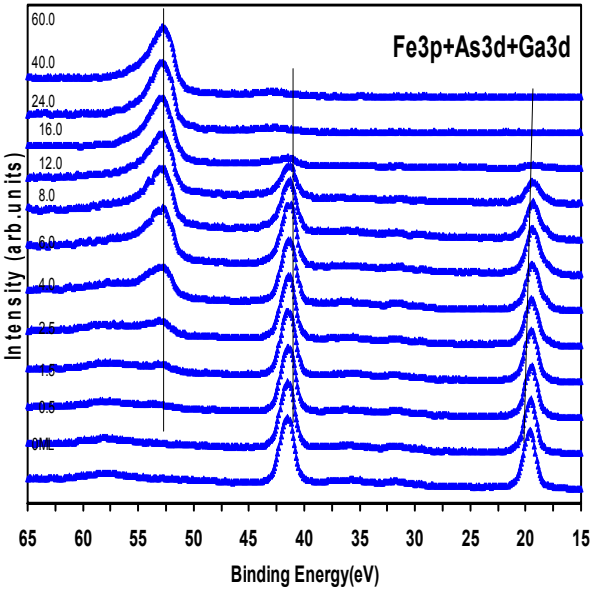
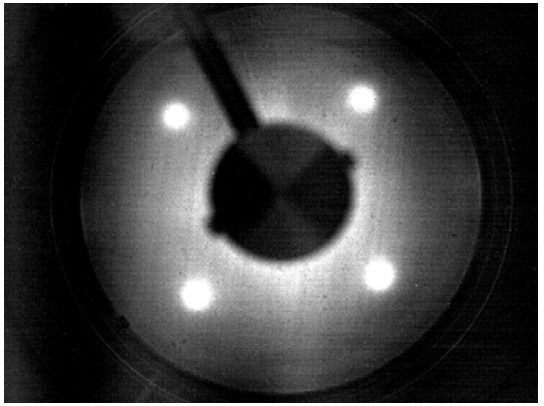
Passivation and Heteroepitaxial Growth of Fe on GaAs

Paul Lyman, U. of Wisconsin-Milwaukee,

DMR-9984442

"Spintronics" aims to use the *spin* of carriers to convey information, and requires high-quality ferromagnetic /semiconducting interfaces. If Fe is deposited on bare GaAs, a deleterious reaction ruins the electronic and magnetic properties of the interface. We have found that smooth, epitaxial Fe overlayers are readily grown if the GaAs(001) surface is first passivated with S using thioacetimide (CH_3CSNH_2) solutions. The XPS results (right) clearly show that the Ga and As features from our S-treated samples are diminished upon Fe deposition, indicating that the interdiffusion seen on bare GaAs is inhibited. The chemical shifts observed in these spectra reveal that at first, Fe-S bonds form, followed by growth of metallic Fe. No evidence for unwanted Fe-As formation is seen. Eventually, a smooth, single-crystal Fe layer is formed as evidenced by LEED (pattern at right). TEM (not shown) confirmed the bcc Fe film was epitaxial. This method promises to allow growth of low-loss interfaces between GaAs and a ferromagnetic spin injection layer.





Novel Growth of Advanced Dielectric Materials

Paul Lyman, U. of Wisconsin-Milwaukee, DMR-9984442

Outreach:

A variety of successful outreach activities has helped the PI relate his laboratory experiences to a wide range of audiences, including school children, undergraduates, and those interested in the medical profession.

The PI shares a discussion with a group of REU students from UWM's REU site.

The PI rides a bicycle down the stairs of a large auditorium as an entrée for his program on the Physics of Medical Imaging. The program was presented to over 1000 children and adults. It was also reprised later for a group of American Indian scholars interested in pursuing a medical profession. (The bicycle was later used as a gyroscope to help explain nuclear magnetic resonance.)